Knowledge-based approach for planning healthy cities: the case of Logan-Beaudesert, Australia

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Abstract

Introduction - The planning for healthy cities faces significant challenges due to lack of effective information, systems and a framework to organise that information. Such a framework is critical in order to make accessible and informed decisions for planning healthy cities. The challenges for planning healthy cities have been magnified by the rise of the *healthy cities movement*, as a result of which, there have been more frequent calls for localised, collaborative and knowledge-based decisions. Some studies have suggested that the use of a 'knowledge-based' approach to planning will enhance the accuracy and quality decision-making by improving the availability of data and information for health service planners and may also lead to increased collaboration between stakeholders and the community. A knowledge-based or evidence-based approach to decision-making can provide an 'out-of-the-box' thinking through the use of technology during decision-making processes. Minimal research has been conducted in this area to date, especially in terms of evaluating the impact of adopting knowledge-based approach on stakeholders, policy-makers and decision-makers within health planning initiatives.

Purpose – The purpose of the paper is to present an integrated method that has been developed to facilitate a knowledge-based decision-making process to assist health planning.

Methodology – Specifically, the paper describes the participatory process that has been adopted to develop an online Geographic Information System (GIS)-based Decision Support System (DSS) for health planners.

Value – Conceptually, it is an application of Healthy Cities and Knowledge Cities approaches which are linked together. Specifically, it is a unique settings-based initiative designed to plan for and improve the health capacity of Logan-Beaudesert area, Australia. This setting-based initiative is named as the Logan-Beaudesert Health Coalition (LBHC).

Practical implications - The paper outlines the application of a knowledge-based approach to the development of a healthy city. Also, it focuses on the need for widespread use of this approach as a tool for enhancing community-based health coalition decision making processes.

Keywords – Knowledge-base decision-making, Decision Supports Systems, Knowledge cities, Healthy Cities, Participatory Action Research

Paper type – Academic Research Paper

1 Introduction

There has been emerging evidence of clear established links between the application of 'knowledge-based' approaches to planning and its output for quality of life and place (Moutinho, 2006). For instance, there is evidence that 'knowledge-based' approaches may lead to enhanced decision-making processes, increased collaboration between stakeholders and the community, and improved accuracy and quality of planning processes. Consequently, research has emphasised that community health stands to gain significantly from healthy and high quality urban planning. Conversely, the process of developing healthy cities has become an important focus for urban planners (Schulz & Northridge, 2004). However, to make this link effective, some researchers have argued that a new knowledge-based approach is required (Doyle, 2002). This approach should be based on local information, collaborative practice and the engagement of the public in decision-making. The literature emphasises that knowledge-based approaches are associated with a number of benefits including: scientific and evidence-based decision-making, effective planning processes, and more accurate policy making. Conversely, thus far, little research has been conducted on the potential of knowledge-based approaches in planning processes to improve our understanding and knowledge upon the growing impact of social determinants of health on the society wellbeing, create sharing culture and inclusive systems, and develop health and quality of life and place. Therefore, identifying the gap in the knowledge and suggesting effective and practical frameworks to address these issues, forms the basis of this ongoing study. Thus, this paper describes a healthy cities initiative that is based on a knowledge cities approach and suggests applying a new framework and specific methods (e.g. Participatory Actions Research) which are aiming to address these research components.

2 The healthy cities approach: the role of knowledge

In many cities around the world, the cost of health to society will significantly increase in the next few decades (Anderson et al. 2006). Varying responses have emerged regarding the best way to address rising health costs, one of which is the Healthy Cities initiative. The 'Healthy Cities' initiative was officially introduced in 1986 by Ilona Kickbusch at a conference of the World Health Organisation (WHO) in Copenhagen, Denmark. To date, over 1000 cities around the world have initiated healthy city programmes (WHO, 1999). The most commonly used definition of a healthy city is *'one that is continually creating and improving those physical and social environments and strengthening those community resources which enable people to mutually support each other in performing all the functions of life and achieving their maximum potential'* (Flynn, 1996). Healthy cities movement is also seen as a key component of the knowledge cities movement. In order to plan effectively for healthy cities, it is necessary to revive the historic collaboration between urban planning and public health professionals, and together conduct informed knowledge-based decision-making (Northridge et al., 2003). In other words, health planning efforts must focus on the creation of structures and processes that actively work to dismantle existing health inequalities and to create economic, political, and social equality (Schulz & Northridge, 2004).

One of the reasons why planning has not been able to contribute to the healthy cities movement is that there are no models to define the type of information that must be

considered by health planners and there is no method for sharing this information in a meaningful form. It is, therefore, important for planners to have a clear understanding of a healthy city so they are clear about the desired outcomes. In this regard, Duhl and Sanchez (1999) defined six fundamental characteristics (see Figure 1) that would be necessary to create a healthy city. If these characteristics are facilitated, it is likely that a healthy city will emerge. Interestingly, one of these characteristics is innovation, an element that is often missing from many public health initiatives (Kendall et al. 2009). However, as Flynn (1996) concluded, every community is unique, with different physical, social, political and cultural contexts that must be understood in the planning process. Therefore, it is necessary for planners to develop a thorough understanding (based on a knowledge-based approach) of each individual community health profile and the local features that are likely to influence health. Consequently, planners require both a broad framework within which to understand a healthy city and a structure that will allow them to collate localised data in a meaningful way.

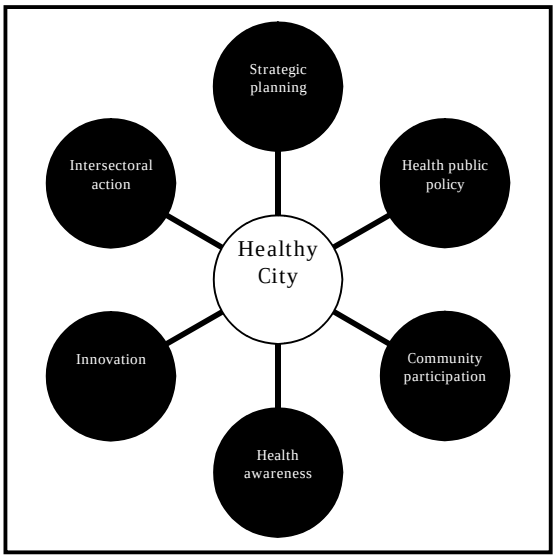

Figure 1: The six area of results, characterised a healthy city (WHO, 1997)

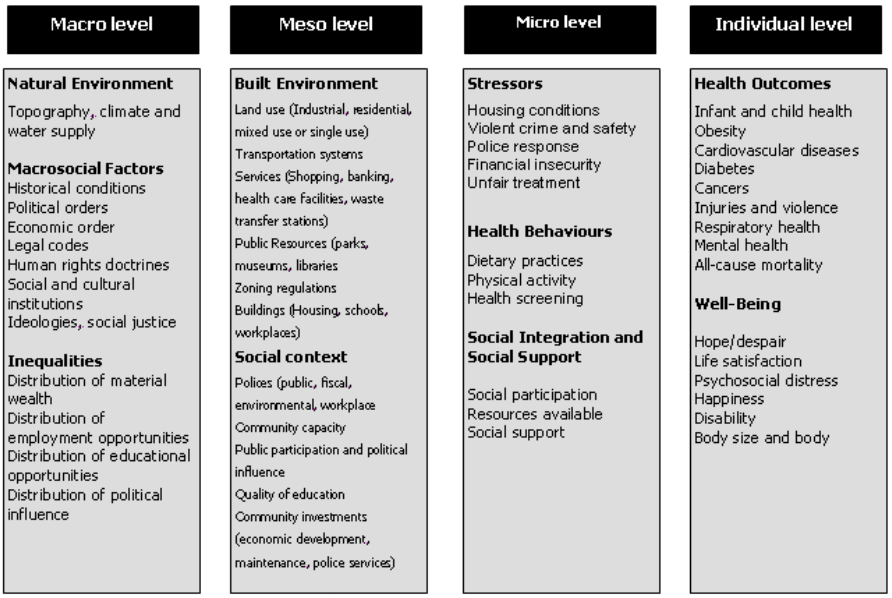

Figure 2: Public health framework for health impact assessment and health profiling (Schulz & Northridge 2004)

Schulz and Northridge (2004) have developed a public health framework for health impact assessments (see Figure 2) that provides some utility for urban planners who are engaging in healthy cities initiatives. This framework summarises the different levels of factors that impact upon health and, therefore, should be considered in health planning processes. According to Northridge et al. (2003), factors that contribute to health can be divided into four levels, namely: Macro, Meso, Micro and Individual. According to the model, these factors interact to contribute to health in the community. For instance, the natural environment, macro social factors, and inequalities (i.e., macro factors) influence health outcomes and well-being (i.e. individual level factors) via multiple pathways through differential access to power, information, and resources. These macro factors, in turn, influence meso factors (i.e. the built environment and the social context). Meso factors include the development of land use policies. At this level, the impact of the built environment on health is especially important to policy management by planners. Some researchers have argued that meso factors have been given greater scientific attention in recent years (Northridge et al., 2003). However, the micro factors are more commonly the realm of public health practitioners and have been the focus of research for many years. Three domains are considered relevant at this level: stressors, social integration/support, and health behaviours. The last column in Figure 2 contains two domains: health outcomes and well-being, as these in turn influence the individual habits. Thus, an individual's eventual health outcome could be explained by the impact throughout his or her life course of multiple factors contained in this framework.

3 Knowledge cities: prospects, challenges and tools

The concept of knowledge cities plays a fundamental role in knowledge creation, economic growth and development. Research has emphasised that if Knowledge cities are to be developed, a more knowledge-based urban development (KBUD) approach should be adopted within urban planning initiatives (Yigitcanlar et al., 2008a). For instance, Van Winden et al. (2007) suggested in their framework that quality of life is one of the essential characteristics of a knowledge city. Thus, it would seem that the healthy cities movement and the knowledge cities movement are inherently linked and may complement each other. According to the literature, features of a Knowledge City include a knowledge sharing culture, the use of knowledge-based development and decision-making and information and communication technology (ICT) systems that are similar to the common features of Healthy Cities. In this sense, Meang and Budic (2010) suggested ICT tools were essential to understanding Knowledge-based development approaches, and should be an integral component in urban planning processes. Hence, ICT tools should also be considered to be an essential component of healthy cities planning efforts.

The literature points out that the prospects and challenges faced by today's decision-makers are to move beyond decision-making by intuition to what was identified as knowledge-based decision making (KBDM) (Doyle, 2002). Broadly, it is suggested that data must be transformed to knowledge; knowledge needs to be translated into wisdom, and wisdom needs to guide action. So, it could be outlined that data collection is a resource. But, even with data and solid evidence, that in theory should improve decision-making practice, yet, it is not a recipe for successful decision-making processes. Thus, decision-making is much more complicated than translating data into knowledge, it is some times moral, political or intuitive decision which is based partiality on high-quality data. In this sense, decisions could still be made on solid data, but overall judgment and comprehensive sight of the larger context are essential components too. For instance, Doyle (2002; page 33) summarises (in an adequately manner) the way decision-making should be supported as: *"it should be informed by facts; it should be supported by rigorous analysis; and it should be subject to constant re-analysis and reinterpretation"* Given that decisions are being made some times under uncertainty and ambiguity conditions, it is expected that they will be based on intuition too. Thus, overall, it can be suggested that KBDM are mixture of scientific evidence-based on information and professional judgment, experience, insight and intuition which can lead to informed and effective decisions.

However, the literature also draws great potential benefits by using ICT tools as a facilitator of KBDM. Decision support system (DSS) are ICT tools, which include geographic information systems (GIS), provide mechanisms to help its users to assess complex problems and solve these in a meaningful way. Some researchers claim that GIS-based DSS have the potential to improve both the availability of information and quality of decision making processes by combining *"communication, computing and decision support technologies to facilitate formulation and solution of unstructured problems by a group of people"* (Desanctis & Gallupe, 1987; page 589). Further, another advantage of GIS-based DSS is that they visualise input information, decision-making processes, assessment, analysis and results (Yigitcanlar 2008b). According to the literature, this capacity to share information visually improves stakeholders' involvement in decision-making, promotes 'horizontal' knowledge sharing and helps simplify the decision-making process (Dur, Yigitcanlar & Bunker 2009). Accordingly, GIS provides the computational, analytical, problem-solving and visualisation capabilities necessary for a spatial DSS (Dur, Yigitcanlar & Bunker 2009). Thus, 'spatialised information' in the

form of maps generated from local knowledge, private, government or commercially available datasets can be mapped. These maps can then be superimposed in an unlimited range of variations, to provide the basis for analytical analysis.

Yet, understanding how GIS-based DSS works in practice is critical if we want to influence planning processes and re-orient health planning towards more knowledge-based approaches (Rushton et al. 2010). For instance, Mooney and Fohtung (2008, page 27) urge that: *"Making adequate and relevant information available becomes paramount if health policy-makers are to embrace adequately the prospects of attracting investments in and, equally important, interest in the social determinants of health"*. Yet, the literature also emphasises that there is a limited amount of research upon collaborative technologies and group decision-making processes (Chen et al. 2007). Also, it seems right that questions such as, what constitutes 'evidence', 'scientific reasoning', potential impact and knowledge-based decision-making processes will need to be re-examined if we want to adopt a truly local, inclusive approach for planning healthy cities. Thus, based on our literature findings, we have recognised that a new conceptual framework to re-examine these questions is essential to be developed.

4 Conceptual framework for the planning of healthy cities

Broadly, it is proposed that the overall conceptual framework will be based on knowledge-based decision-making approach. It is expected to contribute to a broader conceptualisation of the health-related issues to be addressed in a particular city. In this regard, Mooney and Fohtung (2008) stated, that thorough understanding of the complex relationships between social determinants and health outcomes may lead to more knowledgeable interpretation of health-related findings. It is therefore imperative that the DSS be based on a broad information framework. This in turn, allows health planners to develop powerful knowledge-based and effective spatial techniques to address complex questions about the determinants of health. A broad framework has been proposed for health planning (see Figure 3) that illustrates the overall place of DSS within a healthy cities' planning initiative. Specifically, it is suggested that the health profile component which is based on Schulz and Northridge (2004) model, should guide the development of a community health profiling, with information being derived from multiple sources. The ability to present this information in meaningful, accessible and usable ways is a critical challenge for establishing healthy cities. Particularly, this framework suggests that by utilising a DSS as part of a broader healthy city planning process, and a knowledge-based approach, it is more likely that healthy city will be established. Thus, accordingly, the proposed framework suggests integrating some of the previous shown models into one comprehensive framework. However, it was also recognised that it was necessary to test the application of the proposed framework in a real case-study.

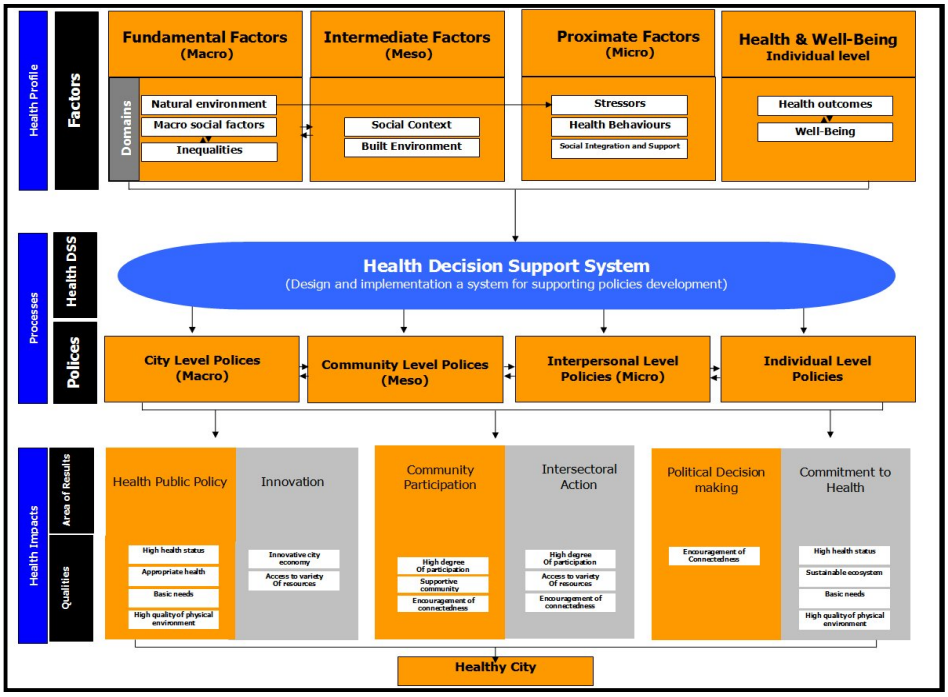

Figure 3: A conceptual framework for planning a healthy city (Modified after World Health Organization 1997; Schulz & Northridge 2004)

5 Case study: the Logan Beaudesert health coalition

The Logan Beaudesert health coalition (LBHC) is a partnership established to address the growing level of chronic disease risk factors in the Logan Beaudesert region of Queensland, Australia. The initiative intended to build on work that had preceded it, enhancing existing services and infrastructure, establishing formal partnerships and mechanisms to improve the coordination of existing resources as well as planning for additional services and strategies. It was initiated with a view to improving health capacity at multiple levels through improved and responsive localised planning. The coalition has a central board committee which oversees six health initiatives or working groups, each focusing on a specific area identified as needing attention. These working groups focus on the early years of life (0 to 8 years), multicultural health, prevention and management of existing chronic disease, integration between general practice and acute settings, efficient management and transfer of health information and health promotion. Each group has a leader or project manager and a selected group of key stakeholders from across multiple sectors or relevant organisations. The working groups are responsible for facilitating decisions, polices or strategies by providing recommendations and

information to the LBHC board. The LBHC board role is to coordinate and direct the coalition as a 'whole'. The Queensland State Government funded the LBHC and has given mandate to its board to modify, alter or adapt any of the current programs in response to evidence (based on a knowledge-based approach) and performance data with the scope to design and to implement new health initiatives as required. The six health initiatives and their advisory groups are responsible for facilitating decisions polices or strategies by providing recommendations and information to the LBHC board. Additionally, at the board level, decisions are being made whilst decisions are reflected back to the six health initiatives and the advisory groups. So, overall, the LBHC was an ideal platform to evaluate the effect of the DSS, because of considerable challenges it faces in creating a simple, engaging, and usable DSS interface to help members of the board make better decisions. However, subsequent to reviewing the relevant literature, it was also recognised that the process plays an important role in the dissemination and analysis of information by decision-makers, particularly as part of a broader KBDM approach. Also, it is suggested that knowledge-based approaches could be better understand if quantitative and qualitative data are to be collected upon the needs and the prospective impacts in planning responses (Meang & Budic, 2010). In this sense, according to Nan et al. (2009), one of the key requirements of a knowledge-based system is the flexibility to adapt users' needs and therefore, increasing planning processes' efficiency. So, piloting a prospective knowledge-based system is subject to gain important feedback before developing the final product. Thus, in order to collect the overall feedback and evaluate its impact from health planners' perspectives, a specific Participatory Action Research knowledge-based method was designed.

6 Participatory action research, a method for evaluating and implementing a knowledge-based decision-making approach

Participatory action research (PAR) has increasingly been used as an overarching name for an orientation to research practice that places the researcher in position of co-learner and puts a heavy accent on input from participants or end-users and the ongoing translation of research findings into action (Minkler, 2000). Recently, this approach is gaining increased attention in health research, particularly in the public health context (Minkler & Wallerstein, 2003). One of the most important characteristics of PAR is the fact that participants whose lives are affected by the research initiative take an active role in its design. In this regard, Israel et al. (2001) defined PAR as adhering to the following principles:

- Participatory;
- Engaging community members and researchers in a joint process in which both contribute equally;
- A co-learning process for researchers and community members;
- A method for systems development and local community capacity building;
- An empowering process through which participants can increase control over their lives, nurturing community strengths and problem-solving abilities; and
- A way to balance research and action.

Amongst its advantages in the healthy cities and knowledge cities contexts is that it is a ground-up approach driven by the communities rather than top-down driven by experts. This approach strengthens the input from participants by using democratic participatory process driven by community priorities and based on community contribution to create a healthy community. Doyle (2002) suggested that PAR is community-driven approach oriented toward social change, but it is also based on a broader approach to knowledge that recognises multiple forms of knowledge and ways of knowing. Thus, researchers involved in a PAR initiative enter the community as co-learners rather than teachers (Minkler, 2000).

However, a few important limitations need to be noted. Specifically, implementing a PAR approach within a health planning initiative is a time consuming task and requires attention to issues of power, trust, research rigor and conflicting interests for scientists and citizens. However, the literature reveals that through community consultation meetings, many healthy cities have effectively incorporated a high level of community participation (Minkler, 2000; Stern, Gudes & Svoray, 2009). As Minkler (2000) emphasised, PAR offers a promising approach for realising community participation and conceptualising the vision of the healthy cities movement through the process of sharing knowledge.

Enthused by the PAR approach, we suggest using a similar approach while developing a knowledge-based DSS interface. It is suggested to incorporate focus groups, consultation meetings and survey, as suggested by Rowe and Frewer (2009) in their study dealt with public participation methods. Figure 4, illustrates our suggested PAR method for developing a DSS interface. Also, and not less important, this method structures the ways research data may be collected.

Specifically, it is suggested to collect the research data by disseminating a survey to the target group, in our case study it is the Logan Beaudesert Health Coalition (LBHC) consisted of approximately 50 members. Also, it is suggested to incorporate two phases of research data collection, Pre-DSS intervention and Post-DSS intervention. The rationale stands in the basis of this method, is to identify the way decisions were being made prior to the DSS intervention, and to draw the differences subsequently to the DSS intervention. The Post-DSS research data can be collected after few months of trialling the DSS interface. Consequently, it may give decision-makers sufficient time to be familiar with the DSS interface and to work with it on their day-to-day routine. In Figure 4, this is being represented by the Outcomes Evaluation dimension. Importantly, and following Meang and Budic (2010) recommendation, it is also suggested that a qualitative research data will be collected in addition to quantitative data. Thus, it is suggested to execute series of consultation meetings or focus groups, in order to obtain data from end-users in relation to the prospective functionality, data content and features to be included in the DSS interface. These steps should be adopted from the early stages of the design, followed by refinement stages (e.g. represented by the End-users Implementation Dimension in Figure 4) which are designated to obtain feedback from end-users on each version of the DSS interface. This way, stakeholders (e.g. health planners, community representatives etc;) could be consulted in iterative cycles, with each consultation feeding into the further refinement and development of the DSS interface. Further iterations should be focused on the development of an interactive and usable interface, preferred features of the DSS, use of the system and perceived reliability of the outputs. So, this in turn, may generate a mechanism improving the DSS interface on time, and it is being represented in the different refinement circles illustrated in Figure 4 on the PAR Dimension.

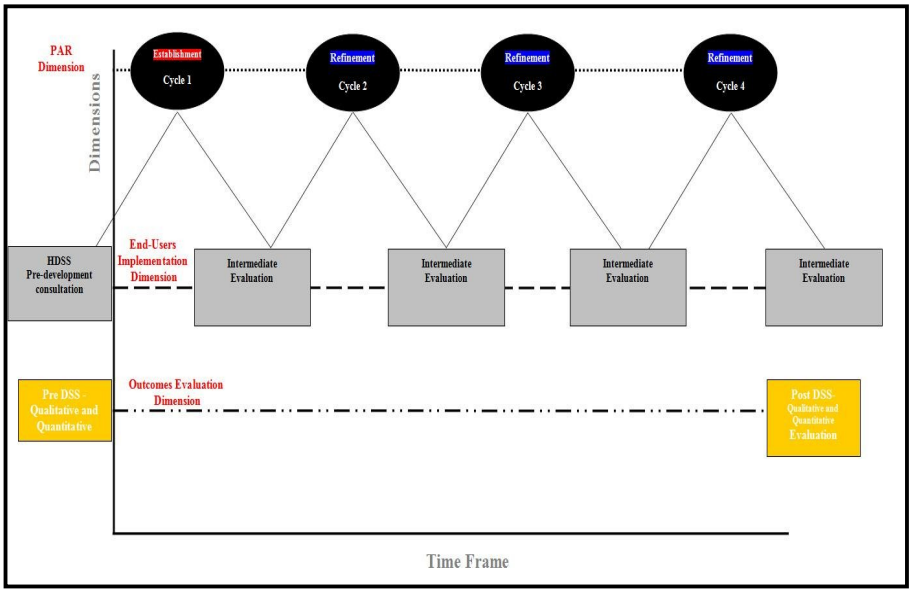

Figure 4: PAR framework for developing a DSS and collecting research data

Additionally, Appendix 1, displays in more detail, the ways in which the PAR approach was executed. Broadly, it is suggested that the dimensions drawn earlier (e.g. in Figure 4) are associated to input or output, related to the development of the DSS interface. Moving right within Appendix 1, we can observe more details such as, the collected data by sub-dimension, sample, method of data collection, duration or timing and the analysis method. Thus, by adopting this specific method, we can identify whether the DSS interface would have a positive impact on the decision-makers as part of a broader knowledge-based decision-making approach. The next sections draw our preliminary findings from the Actual decision-making sub-dimension by adopting qualitative analysis method.

7 Qualitative data-analysis method

Given that this is an ongoing study, only part of our findings will be outlined. As for the Actual decision-making processes sub-dimension (see Appendix 1), we have obtained the research data by collecting the qualitative data based on recordings of LBHC board meetings, minutes and notes. Additionally, we have designed a scale measuring the way decision-making were made during the LBHC board meetings. Specifically, a random selection of seven meetings were analysed to identify the number and nature of decisions made during each meeting. Then, each identified decision was scored (based on five steps Likert scale) and analysed and by two independent researchers.

The scale consists of the following measurements:

1. Degree to which information, evidence and/or knowledge was used to underpin decisions;

2. Quality of the evidence used (i.e., what source, validity and breadth of evidence was used?);

3. Participation in decision-making (i.e., who participated in the decision-making process and what each party brought to the process?);

4. Degree of collaboration (i.e., what latitude was available to the board in the decision-making process? Was the decision already made? Were diverse views taken into consideration etc.?);

5. Degree of consensus (i.e., what was the outcome of the decision-making process? Was there consensus or dissent? How was disagreement handled?);

6. Action orientation of the decision (i.e., were there any planned actions as a result of the decision? How clear were these planned actions?);

7. Opportunity-cost of the decision (i.e., what other decisions or actions were displaced by this decision? Were these opportunity-costs considered, by whom?); and

8. Conclusiveness of the decision (i.e., were there non-decisions or deferrals of decision-making and for what reasons?).

Textual data from minutes, observational notes and audio recordings were analysed for themes relating to decision-making. The abovementioned data was combined and analysed with the Likert score-based data, and this in turn formulated our preliminary qualitative findings of the actual decision-making processes in the Pre-DSS intervention phase.

8 Preliminary qualitative findings

Based on the qualitative analysis, inferences can be drawn about some aspects of the actual decision-making processes. Broadly, analysis of the qualitative data, supports the general statement that lack of information, evidence, deferral of decision-making processes and sense of 'disconnectedness' exists in the LBHC board. For instance, our analysis revealed that only few decisions were actually made during any of the LBHC board meetings, because the board was rarely required to make decisions and the decisions were regularly deferred. Further, during discussions, members often expressed the fact that they did not have sufficient information, knowledge or evidence to formulate a decision. They lacked clarity about how to make decisions and whether or not these decisions would be meaningful. There were usually many unknown parameters which prevented a knowledge-based decision-making process. From the decisions that were finally made, the focus was mostly on internal matters and existing programs with little external focus or relevance to the goals of the LBHC coalition. Based on our findings,

only few decisions were made on the basis of any evidence. As a result, the decisions reflected the views of those who participated in the discussion. Generally, only a few members were involved in discussions where a decision was required. Further, when decisions were finally made, they were often reported to the board as an outcome, indicating that a number of decisions were being made outside of the LBHC board meetings and not by board members. Besides, this was occasionally reflected by the minutes and notes. These findings were also supported by the following LBHC members' comments:

> *"Very few decisions have ever been made by the LBHC Board, most decisions are made by a few outside the meeting, and therefore there is no rigour or transparency to the processes"* or *"Need to identify priority actions, need to be more pro-evidence in decision making"* or *"I thought a decision had been made prior to our input"*.

Other findings support the fact that discussions in the LBHC board demonstrated significant levels of vision, but most decision-making processes lacked the steps to translate these decisions into practice or deliver these decisions more broadly (outward to the LBHC coalition). Also, no processes were applied to manage that lack of consensus in decision-making. This could be underpinned by the following LBHC members' comments:

> *"Problems existed in relation to decision-making processes impact the LBHC sense of connectedness as a whole"*.

Overall, from the above mentioned findings we can conclude our preliminary qualitative findings that LBHC suffers from lack of evidence and information, which are defined in the literature as essential components for knowledge-based decision-making approach. Even though the decisions were made, we have identified lack of action associated with some of them. Some of the decisions were not made consensually or in a participatory manner, this in turn contributes to the sense of disconnectedness, observed in the LBHC coalition.

9 Conclusion and future research

The literature emphasises that knowledge-based development approaches should be an integral component in urban planning processes. Accordingly, our study focuses upon the need for the proposed knowledge-based framework as a tool for planning healthy cities. We have suggested a comprehensive framework to make health information accessible in the light of adopting a more knowledge-based approach. The study has shaded light on the importance of this framework and accordingly suggested a practical PAR approach, as part of broader knowledge-based approach. In this regard, not only the study has discussed the need for an access to effective information (by utilising DSS interface), it also suggested practical method to design and measure their impact (e.g. PAR). So, practically, we have structured our suggested methods to underpin our overarched knowledge-based approach by collecting and evaluating quantitative and qualitative data. Moreover, "making the difference" is subject not only on displaying effective spatial data; it is more about being understandable. Thus, the methods and approaches introduced in

this study may play an important role in planning knowledge-based healthy cites. On the other hand, questions about how the suggested framework and methods are actually applied in planning knowledge-based healthy cities, the impact of the DSS interface on decision-making processes and its ability to facilitate knowledge-based health planning approaches and the application of PAR method in practice, remain unanswered. These important research questions form our ongoing and longitudinal research objectives. In conclusion, it can be summarised that it is essential that city leaders, community agencies and planning bodies will make every effort to acquire new collaborative technologies, or spatial-based collaborative technologies into the healthy cities planning processes, as part of a broader long term knowledge-based development approach of the knowledge cities.

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Appendix 1: Detailed suggested PAR method for developing a DSS interface and collecting research data

Themes	Dimension	Data to be Collected by sub- dimension	Participants or Sample	Method of data collection	Duration or timing	Analysis method
Inputs to the DSS	**Implementation and Content dimension (establishment and refinement stages)**	**Information request (establishment stage) and feedback related to actual data (refinement stage)** **Features request (establishment stage) and system's feedback (refinement stage)**	**LBHC Board members (approximately 12 participants)**	**Ongoing workshops, notes, questionnaires and one on one meetings with pilot participants (LBHC board members)**	**(based on 3 time intervals)**	**Descriptive statistics and inferential statistics**
		Textual description that outlines the process undertaken within the LBHC, starting from the early days till the establishment of the DSS prototype interface up to these days. The implementation dimension is based on three phases: introduction, interaction (with end-users for design purpose) and trialling the interface. *** Data is based on a log book that was prepared to document all activities which were undertaken**				
Outputs evaluation from the DSS	**Outcomes evaluation dimension**	**End-users usage perceivedness:** *** Perceived usage and satisfaction from the HDSS interface** *** Usability and Interface design satisfaction**	**LBHC Board members (approximately 12 participants)**	**Longitudinal Survey** * Data collection will start upon completion of first DSS prototype	**Continual process (starting from prototype phase onwards)**	**Descriptive statistics and inferential statistics**
		Actual decision-making process	**LBHC Board members (approximately 12 participants)**	**Ongoing workshops, notes, minutes, recorded meetings and self-scoring questionnaire** * Based on 7 selected board meetings each time	**Both post and pre DSS intervention**	**Content (themes) analysis of measured data and repeated measures over time**
		• **Perceived evidence-based Decision-making;** • **Perceived importance of Decision-making;** • **Perceived external influence of Decision-making;** • **Perceived equity of Decision-making;** • **Perceived effectiveness of Decision-making;** • **Perceived consensus of Decision-making;** • **Perceived satisfaction with Decision-making process;** • **Perceived participation of Decision-making process;**	**All LBHC (approximately 40 participants)**	**Survey (hardcopy and online) Survey)**	**Both post and pre DSS intervention analysis**	**Descriptive statistics and inferential statistics**